



# INFLUENCE OF HIGH AND LOW ALTITUDE BATTLE ROPE TRAINING PROTOCOL ON SELECTED PHYSIOLOGICAL VARIABLES AMONG NATIONAL LEVEL ATHLETES

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## ABSTRACT

The intention of the study was to find out the influence of high and low altitude battle rope training protocol on selected physiological variables among national level athletes. To achieve this purpose of the study, forty five (N=45) National level athletes were randomly selected from various schools in Idukki and Ernakulam Districts, Kerala, India. The subjects were aged between 13 to 17. They were divided into three equal groups consist of 15 each, Group I underwent High altitude battle rope training group, Group II underwent Low altitude battle rope training group and Group III acted as Control group. The control group did not participate in any kind of special training programme apart from the daily physical activities as per the curriculum. In this study selected physiological tests were carried out on each student. These included respiratory rates were measured by using expirograph, Vital capacity assessed by web spirometer. The Battle rope training group participate training for 4 days in a week, one session per day and for 12 week each session lasted 60 minutes. All the subjects of the three groups were tested on selected dependent variable at prior and after the training programme. The analysis of covariance (ANCOVA) was used to analyze the significant improvement. Whenever the obtained 'f' ratio for adjusted post-test means was considered to be significant, the scheffe's test was applied, as a post hoc test to determine the paired mean differences. In all cases 0.05 level of confidence was fixed as the level of significance to test the 'f' ratio obtained by the analysis of covariance, the result of the study indicated that influence of high and low altitude battle rope training protocol on selected physiological variables among national level athletes.

**KEY WORDS:** Battle rope, High altitude, Low altitude, Respiratory rate, Vital capacity.

## INTRODUCTION

The Battling Ropes (BR) System was created and developed by John Brookfield. John is a multiple world record winner and the author of the popular book, *Mastery of Hand Strength*. Battle ropes are generally used as a high intensity interval training (HIIT) tool to develop an athlete's strength, power, explosiveness, as well as their anaerobic and aerobic endurance.

Battle ropes (BR) come in all shapes and sizes, typically ranging from 26-50ft in length, and are anywhere between 1 to 2 inches thick. Their weight is varying depends upon the length and thickness of the rope. When starting the training, the rope is wrapped around an anchor point, and an athlete holds the rope at its end point, which is usually wrapped in thick tape.

The theory behind High Altitude Training (HAT) is that if you can adjust your body to perform at competitive levels with less oxygen in your blood and muscles, then when you go to sea level to compete you should have a higher level of endurance. The "extra" oxygen will prevent the early build-up of lactic acid and keep your heart rate lower even though you are pushing yourself harder than at altitude.

## OBJECTIVE OF THE STUDY

The Purpose of the study was to find out the influence of high and low altitude battle rope (BR) training protocol on selected physiological variables among national level athletes.

## HYPOTHESIS

The study was hypothesized that there would be a significant improvement on the selected physiological variable due to High altitude Battle rope training.

The study was hypothesized that there would be a significant improvement on the selected physiological variable due to Low altitude Battle rope training.

The study was hypothesized that there would be more significant improvement in high altitude training compared to low altitude training on selected physiological variables due to Battle rope training.

## METHODOLOGY

To attain this purpose of the study, Thirty (N=45) National level athletes were randomly selected from various schools in Idukki and Ernakulam Districts, Kerala, India. The subjects were aged between 13 to 17. The subject were divided into three equal groups consist of 15 each, Group I underwent High altitude battle rope training group, Group II underwent Low altitude battle rope training group and Group III acted as Control group. The control group did not give any kind of training programme apart from the regular physical activities as per the curriculum. In this study selected physiological tests were execute on each student. These comprise respiratory rates were measured by using expirograph, Vital capacity assessed by web spirometer. The Battle rope training group participate training for 4 days in a week, one session per day and for 12 weeks each session lasted 90 minutes. The subjects of all the three groups were tested by selected dependent variable at prior and after the training programme. In this study the analysis of covariance (ANCOVA) was used to analyze the significant improvement. Whenever the obtained 'f' ratio for adjusted post-test means was to find out to be significant, the scheffe's test was applied, as a post hoc test to determine the paired mean differences. In all cases 0.05 level of confidence was fixed as the level of significance to test the 'f' ratio obtained by the analysis of covariance, which was considered as an appropriate.

## FINDINGS

### Respiratory Rate

The data are analyzed and the results pertaining to analysis of covariance on respiratory rate of pre-test, post-test and adjusted post-test score of high and low altitude battle rope training group and control group are presented with the help of table I.

**TABLE I**  
**ANALYSIS OF COVARIANCE OF THE DATA ON RESPIRATORY RATE BETWEEN PRE-TEST POST-TESTS AND ADJUSTED POST-TEST OF HIGH AND LOW ALTITUDE BATTLE ROPE TRAINING GROUP AND CONTROL GROUPS**

Test	High Altitude Battle Rope Training Group	Low Altitude Battle Rope Training Group	Control Group	Source Of Variance	Sum Of Squares	Df	Mean Squares	Obtained 'F' Ratio
Pre-test Mean	14.66	14.46	14.00	Between within	3.51 39.06	2 42	1.75 0.93	1.88
Post-test Mean	11.93	12.80	14.00	Between within	32.31 29.33	2 42	16.15 0.69	23.13*
Adjusted Post test Mean	12.95	14.57	15.60	Between within	25.31 12.21	2 41	12.69 0.29	42.62*

\*Significant at 0.05 level of confidence.

(The table value required for significant at .05 level of confidence for 2 and 42 and 2 and 41 are 3.21 and 3.22 respectively).

Table I shows that the pre-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 14.66, 14.46 and 14.00 respectively. The obtained 'F' ratio of 1.88 for pre-test means was lesser than the table value of 3.21 for df 2 and 42 required for significant at 0.05 level of confidence. The post-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 11.93, 12.80 and 14.00 respectively. The obtained 'F' ratio of 23.13 for post-test means was greater than the table value of 3.21 for df 2 and 42 required for significant at 0.05 level of confidence. The adjusted post-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 12.95, 14.57 and

15.60 respectively. The obtained 'F' ratio of 42.62 for adjusted post-test means was greater than the table value of 3.22 for df 2 and 41 required for significant at 0.05 level of confidence.

The result of the study indicated that there was a significant improvement on high altitude battle rope training group and low altitude battle rope training group on respiratory rate.

Since, when compared in these three groups, whenever the obtained 'f' ratio for adjusted post-test was found to be significant, the scheffe's test to find out the paired mean difference and it was presented in table II.

**TABLE II**  
**THE SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN PAIRED MEANS ON RESPIRATORY RATE**

High Altitude Battle Rope Training Group	Low Altitude Battle Rope Training Group	Control Group	Mean Differences	Confidence Interval value
12.95	14.57		1.62	0.50
12.95		15.60	2.65	0.50
	14.57	15.60	1.03	0.50

*\*Significant at 0.05 level of confidence.*

The table II shows that the mean difference values between high altitude battle rope training group and low altitude battle rope training group, high altitude battle rope training group and control group, low altitude battle rope training group and control group are 1.62, 2.65, 1.03 respectively on respiratory rate which was greater than the required confidence interval value of 0.50. Hence it was significant at 0.05 level of confidence.

The result of the study showed that there was significant improvement exist between high altitude battle rope training group and low altitude battle rope training

group, high altitude battle rope training group and control group and low altitude battle rope training group and control group on respiratory rate.

#### Vital Capacity

The data are analyzed and the results pertaining to analysis of covariance on vital capacity of pre-test, post-test and adjusted post-test score of high and low altitude battle rope training group and control group are presented with the help of table III.

**TABLE III**  
**ANALYSIS OF COVARIANCE OF THE DATA ON VITAL CAPACITY BETWEEN PRE- TEST POST-TESTS AND ADJUSTED POST-TEST OF HIGH AND LOW ALTITUDE BATTLE ROPE TRAINING GROUP AND CONTROL GROUPS**

Test	High Altitude Battle Rope Training Group	Low Altitude Battle Rope Training Group	Control Group	Source Of Variance	Sum Of Squares	Df	Mean Squares	Obtained 'F' Ratio
Pre-test Mean	4.99	4.81	4.73	Between within	0.54 10.17	2 42	0.27 0.24	1.13
Post-test Mean	5.64	5.10	4.73	Between within	6.21 8.97	2 42	3.10 0.21	14.53*
Adjusted Post-test Mean	5.15	4.87	4.51	Between within	1.83 1.17	2 41	0.91 0.02	32.05*

*\*Significant at 0.05 level of confidence.*

(The table value required for significant at .05 level of confidence for 2 and 42 and 2 and 41 are 3.21 and 3.22 respectively).

Table III shows that the pre-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 4.99, 4.81 and 4.73 respectively. The obtained 'F' ratio of 1.13 for pre-test means was lesser than the table value of 3.21 for df 2 and 42 required for significant at 0.05 level of confidence. The post-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 5.64, 5.10 and 4.73 respectively. The obtained 'F' ratio of 14.53 for post-test means was greater than the table value of 3.21 for df 2 and 42 required for significant at 0.05 level of confidence. The adjusted post-test means of high altitude battle rope training group, low altitude battle rope training group and control group were 5.15, 4.87 and 4.51 respectively. The obtained 'F' ratio of 32.05 for adjusted post-test means was greater than the table value of 3.22 for df 2 and 41 required for significant at 0.05 level of confidence.

The result of the study indicated that there was a significant improvement on high altitude battle rope training group and low altitude battle rope training group on vital capacity.

Since, three groups were compared, whenever the obtained 'f' ratio for adjusted post-test was found to be significant, the scheffe's test to find out the paired mean difference and it was presented in table IV.

**TABLE IV**  
**THE SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN PAIRED MEANS ON VITAL CAPACITY**

High Altitude Training Group	Low Altitude Training Group	Control Group	Mean Differences	Confidence Interval value
5.15	4.87		0.28	0.13
5.15		4.51	0.64	0.13
	4.87	4.51	0.36	0.13

*\*Significant at 0.05 level of confidence.*

The table IV shows that the mean difference values between high altitude battle rope training group and low altitude battle rope training group, high altitude battle rope training group and control group, low altitude battle rope training group and control group are 0.28, 0.64, 0.36 respectively on vital capacity which was greater than the required confidence interval value of 0.13. Hence it was significant at 0.05 level of confidence.

The result of the study showed that there was significant improvement exist between high altitude battle rope training group and low altitude battle rope training group, high altitude battle rope training group and control group and low altitude battle rope training group and control group on vital capacity.

#### DISCUSSION ON FINDINGS

The result of the study on respiratory rate indicates that all the experimental groups namely high altitude battle rope training group and low altitude battle rope training group brought about significant improvement after the training programme. The study shows that there was more significant improvement in high altitude battle rope training group compare to low altitude battle rope training group. The analysis of the data indicates that there was no significant improvement on respiratory rate and vital capacity between control groups. Several studies have suggested that altitude training may enhance respiratory rate and vital capacity, because the oxygen content in altitude area is very less, hence due to high altitude battle rope training has been shown to have a significant improvement on respiratory rate and vital capacity. Some studies proved that battle rope training had a positive effect to improve the respiratory rate and vital capacity, Bobu Antony (2015) [5]. Some studies proved that high and low altitude training had positive effect to improve the respiratory rate and vital capacity, Benjamin D. Levine and James Stray-Gundersen (1997) [83], James Stray-Gundersen and Robert F. Chapman (2001) [91]. But there were limited studies compare with high and low altitude training and battle rope training on respiratory rate and vital capacity. The present research has also showed that for significant improvement on respiratory rate and vital capacity high altitude battle rope training is greater than the low altitude battle rope training group to be. Previous studies did not found in particularly comparison of high and low altitude battle

rope training.

### CONCLUSION

On the basis of the interpretation of data the following conclusion was drawn from this study.

1. There was a significant improvement among high altitude battle rope training group and low altitude battle rope training group on respiratory rate.
2. There was a significant improvement among high altitude battle rope training group and low altitude battle rope training group on vital capacity.
3. There was more significant improvement among high altitude battle rope training group compare to low altitude battle rope training group on respiratory rate and vital capacity.

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